United States Court of Appeals

for the Second Circuit

AMICUS BRIEF

76-7063

UNITED STATES COURT OF APPEALS

SECOND CIRCUIT

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Digitronics Corp., Now Amperex Electronic Corp.,	:	
Plaintiff-Appellant-Appellee,	:	Docket No.
v.	:	76-7063
The New York Racing Association, Inc., Automatic Totalisators (U.S.A.) LTD., Automatic Totalisators LTD., and Premier Equipment Proprietary LTD.,	:	
Defendants-Appellees-Appellants.	:	

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P/S

MOTION FOR LEAVE TO FILE BRIEF AMICUS CURIAE

AND

BRIEF AMICUS CURIAE FOR
DIGITAL SYSTEMS CORPORATION (DSC)

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MOTION FOR LEAVE TO FILE BRIEF AMICUS CURIAE

Digital Systems Corporation (hereinafter DSC), a corporation organized and existing under the laws of the Commonwealth of Pennsylvania, respectfully moves for leave to file the attached brief amicus curiae in support of appellant in the above-entitled case. The consent of all the parties has been requested and, in each instance, denied.

As grounds for this motion, DSC asserts that it and many others similarly situated will be adversely affected by the Lower Court's decision if the Court allows that decision to stand as

precedent in future litigation.

DSC provides computer systems consulting services and makes and sells a computer system known as the Quick-Path Computer. This product is formed by DSC from components including the PDP-8 hardware (utilized in one of the accused systems in the present appeal) and program software in combination with a paper tape punch machine and, in an expanded system, a visual display such as a plotter or cathode ray tube. DSC, an original equipment manufacturer, purchases all of these components from their manufacturers, excepting the software which DSC produces itself. Many man-years were required to develop this program software, which fully defines the system that is sold as a complete machine system capable of directing the operation of numerically controlled industrial machine tools. Neither the PDP-8 hardware alone, nor the program software alone, has this capability, but in combination may form a complete computer system which is operative to generate data for control of associated machine tools.

The Lower Court has held that system claims of a patent which discloses only a system which is hardwire programmed are not infringed by similar systems which incorporates a software programmed digital computer. It is the concern of DSC and many other similarly situated that this ruling will lead to a corollary view that a patented system implemented by software programming a general purpose digital computer is not infringed by similar hardwired systems.

The technique for copying DSC's costly program software on a function-by-function basis is well known, and with this information in hand, a hardwired system for performing the same functions can be readily constructed. There is also the increasingly popular implementation medium known as firmware, which may be employed to construct a system which is functionally the same as either a hardwired or a software programmed system.

It is DSC's view that a patented system, whether it is disclosed as a hardwired implementation, a firmware implementation or a software programmed implementation, or any mix of these several modes of implementation, should be afforded protection against infringement by alternative modes of implementation, singular or mixed.

Also of concern to DSC and other similarly situated is the manner in which the Lower Court evaluated the appellant's invention for patentability. It appears that the patent statute and the pertinent case law interpreting that statute have been largely ignored and replaced by the subjective notions of the Lower Court. This arbitrary treatment of the appellant's patented invention is not likely to engender confidence in our patent system, which includes the Federal Courts as the judicial arms of enforcement of administratively granted patents. Both a patentee and one seeking the grant of a patent should be able to feel confident that the patent statute will be applied evenhandedly and consistently to

all patents brought before the Federal Courts and that the decisional law of the Higher Courts interpreting the patent statute and specifying the manner in which it is to apply will be faithfully followed by the Lower Courts.

Finally, the decision of the Lower Court appears to be at least partially based on certain misapprehensions of the pertinent technologies. From its vantage point as a computer system manufacturer, DSC believes it can contribute to this Court's understanding of the true nature of the programmable digital computer and its relationship to the other elements of a computer system. Thus, in order to present its analysis in support of appellant's position regarding equivalents patentability and technological realities of this case, DSC respectfully requests that the Court grant leave to file the attached brief amicus curiae.

Respectfully submitted,

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AFFIDAVIT OF CHARLES W. SIMS

Charles W. Sims, being duly sworn, deposes and says that:

1. He is counsel for Amicus Curiae Digital Systems Corporation in the above-identified action.

2. He drafted the accompanying Motion For Leave To File Brief Amicus Curiae.

3. Each of the statements of fact in the accompanying Motion for Leave To File Brief Amicus Curiae is true on his own knowledge or, on information and belief, is believed to be true.

Charles W Sims

Charles W. Sims

Subscribed and sworn to before me

this 3rd day of August, 1976.

Emma J. Schafer

EMMA J. SCHAFER, Notary Public
In and for Montgomery County, Ohio
My Commission Expires Nov. 2[illegible], 1976

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BRIEF AMICUS CURIAE FOR
DIGITAL SYSTEMS CORPORATION (DSC)

I.

QUESTIONS PRESENTED

1. Within the art of an industrial application of digital computing technology, whether the test of obviousness mandated by 35 U.S.C. 103 is appropriately defined as specific to knowledge of the given industry as opposed to structuring of digital computing machines or machine systems in an arbitrary context.

2. Whether a new machine permanently or temporarily struc-

tured by software interconnection of the components of an old general purpose digital computer is, during the time of its existence, the same or equivalent machine as a prior existing special purpose computer permanently structured by hardware programming to perform the same or equivalent machine functions.

II.

INTEREST OF THE DIGITAL SYSTEMS CORPORATION

This brief amicus curiae is submitted by the Digital Systems Corporation of Pennsylvania, (hereinafter referred to as DSC), in accordance with F.R.A.P. 29.

DSC is engaged in the design, manufacture, and sale of machine systems implemented, at least in part, by program software which, when combined with the hardware commonly known as general purpose digital computers, restructures such hardware into new and enhanced machine systems having capabilities not present in the hardware as sold by the manufacturers. DSC is exemplary of industrial systems engineering firms who produce and sell special purpose digital computers structured in accordance with specifications particular to a given industrial environment. These systems engineering firms have made heavy investments of their ingenuity, time, effort and capital in making highly significant contributions to the arts of computer systems design, which contributions are deserving of patent protection, presumably to be denied by any logical extension of the

holding of the Lower Court.

Although DSC does not have any direct interest in the patent application of appellant, DSC does have a deep and abiding interest in the determination of the broader issues in this case, since this Court's decision presumably will treat with the scope of patent protection for machines or machine systems the functioning of which is determined either completely or in part by the application of digital computing technology. The resolution of these issues in favor of appellant will effect the development of the many useful arts employing digital computing technology in the United States in a beneficial manner.

This brief undertakes to refute certain inappropriate technical characterizations of digital computing devices, notably those respecting the nature of the interaction of program software with other elements of combinations defining machine system implementations. Such characterizations, regrettably, have gained currency and caused great uncertainty in the law. Alternative characterizations more in keeping with technical reality will be presented, showing that a computing machine system implementation, physically realizable at least in part by software program means is a distinct physical entity as opposed to a mere use of a known machine.

Thus, it is DSC's position that the Lower Court indulged in an unwarranted extrapolation of the Supreme Court's decision in Gottschalk v. Benson, 409 U.S. 63 (1972).

III.

THE NATURE OF DIGITAL COMPUTING MACHINES AND THEIR PHYSICALLY INCORPORATED ALGORITHMS

A given digital computing machine having an organized purposeful structure may readily be distinguished from arrangements of electronic elements collectively suitable for adaptation to a wide variety of possible end uses. No matter how intricate may be the interrelation of the general adaptable structure or predictable the spatial juxtaposition of certain elements, no specific machine may be said to exist for the simple reason that no specific purpose is served by that which is intended to be general. In order that a specific purpose be served, there must be first a specification of such with sufficient particularity that the more purposeful structure is unambiguously defined. There must then be performed certain steps in planning the precise interconnection of elements to form myriad arrangements of computing circuits suited to an implementation of the specification. Ultimately, a physical embodiment of the specification is brought into existence, usually by means of substantial expenditure of time and energy in troubleshooting and successively refining <u>both</u> the original specification <u>and</u> its physical embodiment.

The terms introduced and distinctions drawn in the instant discussion are those necessary to permit a generalization, or, more precisely, a derivation of a least common denominator of concepts which can be said to have had general currency for roughly three

decades[1]. From the earliest days of electronic computing there has been the clearcut distinction between efforts to improve physical electronic capabilities of the basic elements while optimizing their adaptability and those efforts expended in adapting successive "generations" of these basic computational tools to form digital computing machines adapted to ever more sophisticated end uses[2].

Various means have been employed to carry a conceptual specification of a computing machine into the fully-formed entity purportedly specified thereby. Early machines were formed by permanently wiring together individual computing elements to form

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1. The first known account of the existence of an electronic digital system, "Machine Remembers", appeared in the January 15, 1941 issue of the Des Moines Tribune. The "machine" was the first special purpose digital computer, development of which began sometime in 1938 at Iowa State College (now Iowa State University) under the direction of Dr. John V. Atanasoff. Significant contributions having been made by Dr. Clifford E. Berry, the machine is referred to simply as the Atanasoff-Berry Computer. No technical report was every published. The first technical report to be widely circulated, upon its being declassified, describing in detail the principle of operation of the first electronic computer to be used to any extent, was entitled National Defence Research Committee AMP Report 171.2R. "Description of the ENIAC and Comments on Electronic Digital Computing Machines", by J. P. Eckert, J. W. Mauchly, H. H. Goldstine and J. G. Brainerd, dated November 30, 1945.

2. That adaptations of the various computational tools may accurately be denominated machines has a sound basis in the theories of electronics and computer science. M. L. Minsky, Computation: Finite and Infinite State Machines, Prentice-Hall, Inc., Englewood Cliffs, New Jersey (1967), p. 200. This is presently a basic text of computer science, and was used originally as a textbook in the Department of Electrical Engineering at the Massachusetts Institute of Technology.

logically defined classes of computing circuits, the interaction of which might be viewed as analogous to the exercise of logic[3]. More specifically, machines typically formed by successive wiring refinements of the original specification may be viewed as ultimately responding, in a logical manner, to input data signals representative of an external environment to provide results meaningful within that specific context. Thus, there derives the term "hardwired logic" often referenced by the term "hardware", although the latter term is, in fact, more general.

Advances in technology permitted structural definitions of increasingly complex computing circuits and interconnections thereamong with little or no loss of generality. Thus, one seeking to specify and implement a specific computing machine was provided with new media of implementation equivalent to collections of the original basic computing or logic elements. These previously hardwired collections each performed more elaborate operations upon their having been interconnected in accordance with a structural definition of a specific computing machine. There was seen an evolution of adaptable general structure roughly along the lines of definitions of building blocks having a pyramidal organization with the basic logic elements at the lowest level and successively more sophisticated means for defining their interaction moving upwardly,

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3. Martin Gardner, Logic Machines and Diagrams, McGraw-Hill Book Company, Inc., New York (1958).

notably, complex circuit organizations and the various means for dictating their interconnections.

Implicit in the notion that adaptable general structure must become structure adapted to an end use in order that there exist any specific computing machine is the assumption that the specific machine is to perform its operations in well-defined sequences often referred to as "logic paths". In performing its operations, direction along given paths, or, equivalently detailed sequencing, is data dependent, i.e., determined according as the attributes of given collections of data signals. From the earliest implementations, specificity of organized purposeful structure has been an attribute determined as a function of the variety of data defining the permissible inputs to the machine and the range of results considered to be adequate to varied solutions of problems derivative from the environment within which the requirement for the machine arises.

Definitions of the attributes of data signals to be processed and the desired characteristic solutions for specific collections of signals having those attributes are typically the first steps in developing an exhaustive specification of detailed sequences for processing identically those signals. Adapting the basic computing elements to physically incorporate all of the desired operation sequences is the technique of forming a specific computing machine which may be considered to have been common to electronic

computing machine development throughout the period of evolution of modern computing technology.

A physically incorporated solution for a specified problem employing modern computing technology has been referred to as an algorithm. Some ambiguity inheres in the selection of the term for the reason that, typically, no distinction is made between the terms computational algorithm and sequencing algorithm although the dichotomy is as absolute as the distinction between abstract formulation and physical realization[4]. It is a truism that the functioning of that which has been physically realized is capable of some abstract expression, but it is a false assumption that all abstractions have a physical realization. Many computational algorithms have been discarded, its having been shown that their physical realizations were either quite beyond the instant state of the art in computing technology or the ambition of anyone concerned therewith. Thus, it is seen that a computing machine fashioned in accordance with a specification of a problem and its solution for well-defined classes (or collections) of data signals is, in fact, a machine fashioned in accordance with a specification of physical interconnections of computational elements or collections thereof, sequenced in accordance with a physically incorporated sequencing algorithm

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4. Professor Minsky has employed the term effective procedure to reference that which is physically incorporated and, in fact, effective in solving the specified problem. Minsky, supra.

along diverse physically defined logic paths during the course of the machine's functioning responsive to specific input signals within the well-defined classes thereof. It is to be stressed at this point that there exists no sequence for a spurious signal, outside of the class, or, equivalently, each computing machine is limited to the processing of the signals for which it has been structured.

There has evolved the general purpose digital computer. The pyramidal organization previously described is retained. The implementation medium is called an instruction set which defines theoretically infinite permissible interconnections of myriad complex circuits, each comprised of primitive electronic elements. That the circuits are not interconnected by the instruction set for the implementation of a given problem solution is as intuitive as the proposition that general excludes specific.

A digital computing machine may be structured by the combination of a general purpose digital computer and a specific stored software program[5].

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5. The software program is incorporated (or stored) in a portion of the general purpose digital computer referred to as the memory, typically at contiguous locations therein referred to as addresses. The stored program is sequentially accessed by a mechanism of the general purpose computer interacting therewith until a condition is sensed by the program dictating a change or branch to a different sequence. Data signals also are stored in the memory to be transferred in and out of immediate access registers upon program demand. There are numerous variations of this characteristic organization. R. K. Richards, Electronic Digital Systems, John Wiley & Sons, Inc., New York (1966).

The act of incorporating the software program often has been termed "softwiring" as opposed to "hardwiring" for the reason that different alterations, permutations and combinations of the instruction set may adapt the general purpose digital computer to the implementation of many sequencing algorithms, each adaptation defining unique circuit configurations and their interconnection. In contradistinction, earlier computing machines were wired for the implementation of a given algorithm and seldom changed. However, it is totally inappropriate to suggest that the distinction between hardwiring and softwiring is equivalent to the distinction between permanent and temporary. Many general purpose digital computers are softwired once and never altered. This is quite common in the field of industrial process control.

There is neither logical nor technical inconsistency in defining the general purpose digital computer as an entity distinct from the special purpose digital computer formed by the incorporation of a software program therein. The entity known as a general purpose digital computer affords a tremendous problem solving capability by providing within a relatively small space all of the various components requisite for fashioning more powerful machines for solving problems derivative each from a specific industrial environment. Circuits are uniquely defined by program software interconnection of various components, these circuits being suitable for storing, retrieving, organizing and manipulating signals representative of

parameters meaningful within the specific industrial context. Thus, the general purpose digital computer expands the ability of the technical community to translate problems perceived in any segment of an industrial environment into machines or machine systems capable of solving such problems. The general purpose digital computer has the inherent potential to be fashioned into a large variety of machines capable of solving a large variety of problems.

Every special purpose digital computer, structured from the components of the general purpose computer, operates solely in accordance with its individual specification. Its specification is its program. The program <u>physically</u> defines the various circuits which manipulate the data signals in accordance with a particular sequencing algorithm which requires <u>identically those circuits</u> for its implementation. A general purpose computer has been said to be a "warehouse of functionally unrelated parts". This is true only in the sense that the relationship of the parts are not defined for the solution of any specific problem. The relationship of the parts are well defined in the mechanical sense but are almost endlessly variable in the electrical sense. Program software in combination with a general purpose digital computer creates what has been termed "instant hardware" in the form of a special purpose digital computer by making the electrical connections which form that computer.

All modern digital computing machines are provided with conditional logic circuitry which is available for algorithm implementation.

Such circuitry enables conditional branching, i.e., selection of the next operation on the basis of the result of a completed operation. The specification of interconnections of conditional logic circuits in a general purpose digital computer is necessary in order that the machine fashioned therefrom, namely, a given special purpose computer, be capable of changing from one functionally operative state to another responsive to events represented by internally manipulated data signals during the course of its functioning.

To exhibit by analogy the relationship of conditional branching to simple logic, one might consider the trichotomy respecting relative magnitudes of two numbers, A and B. Only three possibilities exist:

(1) A is equal to B;

(2) A is greater than B;

(3) A is less than B.

Relating this to a simple compare and branch instruction sequence of the special purpose computer, there is to consider the most basic elements required for utilization of conditional logic circuits incorporated therein. The nature of the internally defined technical problem that is solved will be apparent from a reading of the interaction of the elements:

> Given that one of a plurality of sequences of operations are to be performed according as the result or results of one or more preceding operations and absent human intervention, there must exist at least; a predefined <u>location</u> (immediate access register or

> memory address) in the computer containing a first result, a predefined <u>location</u> (immediate access register or memory address) in the computer containing either a second result or a predefined constant, means for determining the <u>location</u> of both, means for determining the magnitude of the contents of those <u>locations</u>, means for comparing the magnitudes of the <u>located</u> contents, means for <u>locating</u> the memory addresses defining the starting <u>location</u> of each of three possible operation sequences, and means for initiating operation at a particular starting <u>location</u> according as one of the magnitudes is greater than, less than, or equal to the other.

This fundamental concept is developed in connection with the operation of modern special purpose digital computers, although common to the operation of digital computing machines, whether hardwired or softwired. Structural and functional details may vary, but the basic operations are the same. However, an understanding of the specific functioning of the conditional logic circuitry of today's special purpose digital computers is useful in that it facilitates their accurate characterization as machines. While little doubt is expressed that hardwired special purpose digital computers are such.

With reference to the technical exposition appearing herein, it may be shown that the various structural elements of the special purpose digital computer coexist in time as opposed to their existing <u>in mere transitory states</u>. One might observe that the word <u>location</u> has been underlined numerous times. This has been done for the purpose of emphasizing that a compare and branch operation sequence, tens of thousands of which may control the machine's sequencing in a single second, requires that the locations of both

the data and various alternative operating sequences be capable of immediate determination. This determination simply cannot be made if the special purpose computer has not been structured such that its elements coexist in time. In fact, physical linkages exist connecting the various elements which allow orderly transfer of control from one logic path to another.

From the foregoing, it can be seen that a misunderstanding of the technological facts of the structure of special purpose computers which might lead one to confuse the concepts "are not functionally operative at the same time" and "do not exist at the same time" may be cleared up with reference to a single, fundamental principle of operation of the special purpose computer. The various machine means of the special purpose digital computer are no more functionally operative at the same time than are machine means of another machine which is, likewise, structured to perform its operations in an orderly manner. However, they most assuredly exist at the same time. Were this not the case, the special purpose digital computer would be conditioned to function in accordance with only a portion of the industrial problem solution for which it had been structured until a human had intervened, examined displayed intermediate results and then conditioned it to function in accordance with another portion. Concluding this to be an accurate portrayal of the technological facts would be to ignore what is common knowledge, viz. a substantial portion of industry is automated through the utilization of

special purpose computers whose proper functioning requires no human intervention.

IV.

ARGUMENT

A. The Lower Court Indulged In An Unwarranted Extrapolation of Gottschalk v. Benson.

Viewing the present case in the "uncertain light" of Gottschalk v. Benson, 409 U.S. 63, 175 USPQ 673 (1972), the Lower Court concluded that:

> "A combination of means claim comprising a machine system is not infringed by another machine system which does not as a permanent machine system include the same combination of means, and which performs the function to which the patented combination of means is addressed only when its general purpose digital computer element is 'instructed' - programmed - in the processing of the type of raw data to be fed into it. ..." 187 USPQ 640.

Shortly after the Lower Court reached its decision, Benson's "uncertain light" proved to be only a narrow beam. In Dann v. Johnston, 96 S. Ct. 1393, 189 USPQ 257 (1976), a unanimous Supreme Court stated that:

> "... In Benson, the respondent sought to patent as a new and useful process, 35 U.S.C. 101, a method of programming a general purpose digital computer to convert signals from binary coded decimal form into pure binary form. 409 U.S., at 65. As we observed, '[t]he claims were not limited to any particular art or technology, to any particular apparatus or machinery, or to any

> particular end use.' Id., at 64. Our limited holding, id. at 71, was that respondent's method was not a patentable 'process' as that term is defined in 35 U.S.C. 100 (b) ...".

Thus, the Johnston Court has made it abundantly clear that the narrow holding in Benson does not apply to an apparatus or machine system. If there is any lingering doubt on this point, the Court put it to rest in noting that:

> "The Solicitor of the Patent Office argued, before the CCPA, that Benson's holding of non-patentability as to the computer program in that case was controlling here. However, the CCPA concluded that while Benson involved a claim as to the patentability of a 'process', respondent in this case was advancing claims as to the patentability of an 'apparatus' or 'machine' which did not involve discovery so abstract as to be unpatentable. ...
>
> Having disposed of the Board's rejections and having distinguished Benson to its satisfaction, the Court held respondent's invention to be patentable. ... We hold that the respondent's invention was obvious under 35 U.S.C. 103 and therefore reverse." 96 S. Ct. at 1397.

Thus, the Johnston Court did not dispute the CCPA's restrictive interpretation of Benson, but confined itself to the issue of obviousness, thereby giving its approval to that restrictive interpretation. Consequently, the Lower Court's application of Benson to determine the scope of the system claims of the present appellant is erroneous as a matter of law. Indeed, it seems certain that the Lower Court would have refrained from so applying Benson if it had had the guidance provided by Johnston when formulating its decision.

B. The Inventive Process, The Persons Skilled In The Art, And The Technological Realities Of Industrial Digital Systems Design Must Be Understood In Order To Assess Inventions In The Pertinent Art.

1. The Inventive Process In The Arts Employing Industrial Digital Systems Design Techniques.

Among those making significant contributions to the various arts employing industrial digital system design techniques, there is a unitary view of the process of invention of a machine system as including at least these elements:

(1) formulating the machine system problem to be solved derivative from the particular industrial context;

(2) analyzing the requirement for machine system elements in view of the purpose to be served by each;

(3) flow-charting a computational algorithm defining the interaction of the various machine system elements;

(4) devising a sequencing algorithm purportedly defining said computational algorithm; and,

(5) implementation, i.e., successively refining the sequencing algorithm until the machine system problem is solved, in fact.

The fifth element, implementation, has often been referred to as "design with feedback" for the reason that problems encountered during the course of the implementation typically occasion additional

activities along the lines specified in defining "earlier" elements of the inventive process. Thus, until the physical embodiment of the sequencing algorithm exists and has been demonstrated to serve the particular industrial purpose sought to be served, even the formulation of the machine system problem to be solved and the particular elements required to be combined to solve it are subject to reexamination.

In the event that the ultimate vehicle of implementation is a general purpose digital computer, within which there resides <u>all of the physically incorporated sequencing algorithm</u> there might arise questions respecting the technical merits of discrete structural elements thereof. In examining the specific circuit interconnections defining the special purpose computer formed from the general structure found in the general purpose computer, it will be seen that certain circuits are similar to those found in other special purpose computers formed therefrom. In fact, it may be found that entire sequences of operations are common to many sequencing algorithms, and that often these sequences may be found in technical publications, or even textbooks. However, as in all technical contexts, there is a point at which textbook examples are of vanishing significance. That point is soon found when one attempts to characterize a specific sequencing algorithm by small portions common to many. Within the context of the complex inventive process defined herein, it simply cannot be done. In that the ultimate overall structure

is influenced by design feedback, it is often impossible to determine, after the fact, how certain complex circuit interconnections were originally conceived.

In the event that only a portion of the vehicle for implementation is a given general purpose digital computer, physically incorporating <u>only portions of the sequencing algorithm</u>, the technical merits of discrete portions of the machine system implementation are <u>far less</u> meaningful than the manner in which the various portions are distributed among hardwired structural elements and softwired structural elements. It may be the case that routine functions are implemented by means of softwiring the general purpose computer and the more complex functions hardwired. It may be the case that the opposite approach is taken. Many factors influence choices of this sort, e.g., consideration such as ease of maintenance versus cost/performance. Design feedback may derive from technical difficulties encountered in seeking to implement the original conception of the ultimate machine system.

In neither event, nor in another, such as that where all structural elements are hardwired, is it perceived how the ultimate technical merit of that derivative from so complex an inventive process can be readily measured by reliance on that so nebulous as a purely subjective interpretation of the test of obviousness mandated by 35 U.S.C. 103. To examine only the end result, and upon determining that a machine system is in fact new, conclude that it is an

obvious variation of an old machine system or some hypothetical combination of elements of known machine systems, ignores the technological fact that man-years of effort are expended in development of such variations, which variations may define precisely the essence of technical merit for the system as a whole.

2. Persons Skilled In The Arts Employing Industrial Digital Systems Design Techniques.

From a description of the inventive process as set forth herein, it is seen that persons skilled in the arts employing industrial digital systems design techniques are those whose technical insights are valuable within specific, well-defined industrial contexts. This is not to say that a digital system design innovation within a specific industrial context may not have application within another context. It is merely pointed out that some innovators are concerned more with industrial problems and computing machine systems structured to implement their solution[6], while others are concerned

6. Representative of inventions employing industrial digital systems design techniques in a given industrial context is U.S. Patent No. 3,898,439, entitled "System For Operating Industrial Gas Turbine Apparatus and Gas Turbine Electric Power Plants Preferably With A Digital Computer Control System", classified in Class 235, Subclass 151.21. Cited during the course of prosecution were E. Eccles, "The Use of a Digital Computer For On-Line Control Of A Jet Engine", Journal Of The Royal Aeronautical Society, (April 1967) and A. Saddler, S. Tweedy and P. Colburn, "The Electronic Control Of Gas Turbine Engines", Journal Of The Royal Aeronautical Society, (July 1965). The characterization of "the man of ordinary skill in the art" is clearly one having knowledge of gas turbine operation cycles, under at least generator loading and possibly aircraft loading, attempting to achieve optimum control under various turbine operating conditions.

more with innovations defining improvements in the basic building blocks[7]. The obviousness test mandated by 35 U.S.C. 103 has meaning only when applied against inventions in an appropriately characterized subject matter area.

Amicus is not in a position to comment on the intricasies of the totalisator art. However, it is observed that few problems deriving from a highly developed area of endeavor lend themselves to solutions through application of "ABC data processing" techniques. In either the machine tool <u>industry</u> or the totalisator <u>business</u> (as it has been described) <u>automation</u>, which typically includes selection with design feedback of the basic tools of implementation, has been entrusted to those grounded in the engineering disciplines. Automation of a <u>business</u> may be <u>industrial</u> in character as is automation of an <u>industry</u>.

A machine system operating to automate a business or an industry may have inventive merit or it may be merely novel. In either event,

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7. Representative of inventions defining improvements in the basic building blocks available for subsequent adaptation to an end use are the following: U. S. Patent Nos. 3,408,630, entitled "Digital Computer Having High Speed Branch Operation"; 3,571,804, entitled "Method For Execution Of Jumps In An Instruction Memory Of A Computer"; and, 3,348,211, entitled "Return Address System For A Data Processor"; all three classified in Class 340, Subclass 172.5; and, all three demonstrating that there exists "the man of ordinary skill in the art" characterized <u>generally</u> as one concerned with the adaptation of the general purpose digital computer to the broadest definition of end uses and <u>specifically</u> with facilitating <u>comparing</u> and <u>branching</u> to <u>existing locations</u> defined by subsequently incorporated algorithms. One such is entitled "Text Matching Algorithm", the subject of U. S. Patent No. 3,568,156, and desirably having a facility for a <u>theoretically infinite</u> number of branching operations.

the test is not whether it <u>functions</u> in accordance with that which <u>presently appears</u> to be "ABC data processing" principles. There is a clearcut distinction between <u>design</u> and <u>operation</u>. Often a monumental design effort yields a machine simple in its operation. In fact, simplicity of operation is a desirable attribute, and in the normal course of formulating design objectives will seldom be stated for the reason that it is implicit. As respects present appearances, it suffices to say that today's "ABC nuclear reactor design" was yesterday's "quantum jump".

Business machine systems function in accordance with sequencing algorithms physically incorporated therein. The sequencing algorithm as a whole may be highly structured and exceedingly complex, while comprising only simple components. This is not surprising since the same statement can be made about such things as accounting procedures as a whole versus routine bookkeeping functions. Yet, no one would suggest that the accounting procedure is obvious because the routine bookkeeping functions are obvious. By simple analogy within the context of a computational algorithm, one sees the improbability of the existence of one simultaneously familiar with simple machine operations and every conceivable machine incorporating such.

The Lower Court fictionalizes a simpleton, in fact incapable of evaluating the design difficulties in implementing a claimed combination, and elevates him above the inventors of the patented

machine system embodying that combination. Surely, this cannot be the way 35 U.S.C. 103 is to be applied.

3. The Range of Alternatives In Adapting Digital Technology To An Industrial Application.

The machine system designer now has an expanded choice of alternative media of implementation. The media are: (1) hardware, (2) firmware and (3) software. Factors influencing a choice derive from principles of both engineering and economics[8]. No one implementation is the more or the less physical than another. They are functionally equivalent. Structural distinctions are illusory, particularly in view of emerging technology permitting of certain hybrid combinations of the media[9]. A discussion of certain matters intended to clarify these points is included herein.

It has been asserted that software programming creates something physical, viz. "softwired" interconnection of circuits. While true, this is difficult to conceptualize because the general purpose digital computer may be structured to form many special purpose digital computers. Thus, something physical appears to have vanished and to have been replaced by another physical entity, which, in turn, may be replaced by the first entity, or yet another. The

8. "Computers: First the Maxi, Then the Mini, Now It's the Micro", Science, Vol. 186, December 20, 1974.

9. See U. S. Patent Nos. 3,916,385, entitled "Ring Checking Hardware", and, 3,962,683, entitled "CPU Programmable Control System".

mystery of the vanishing physical entities is a source of bewilderment to many. The solution is really quite simple. As a general proposition, no one of the special purpose computers need be a permanent adaptation, nor, as a general proposition is it economically feasible permanently to adapt something so expensive. However, and again, as a general proposition, it is necessary that the <u>means for the adaptation</u> exist over relatively long periods of time. This is accomplished very simply by conditioning the general purpose computer to disgorge the contents of its memory onto a more permanent storage medium immediately prior to the introduction of a new software program. On the external medium are stored, typically for an indefinite period, a set of signals suitable for adapting the general purpose computer again when necessary.

The foregoing has been stated in terms of general propositions. These general propositions apply both to early maxicomputers such as the Honeywell 200 and to more recently developed maxicomputers such as the IBM System/370 series. In contradistinction, minicomputers such as the PDP-8 emerged as vehicles for full-time dedication of a general purpose digital computer to a given use, replacing, in many instances, hardwired logic machines in applications such as refinery and complex machine tool control. Relative ease of implementation coupled with greatly reduced costs indicated the choice of the minicomputer over hardwired logic machines. Implementation is accomplished by means of an <u>adaptable instruction set</u> somewhat less elaborate

than that of the maxicomputer.

In that the industrial contexts were well-defined, replacement of machines was often on a function-by-function basis. According as the magnitude and complexity of the industrial problem, a given hardwired controller had been used to implement all or only a part of the overall sequencing algorithm. Typically, more functions of an overall sequencing algorithm could be physically incorporated into the minicomputer, principally because of increased efficiencies inhering in software programming. Nonetheless, the functional equivalents were there, no matter what structural distinctions were visible to the eye.

There arrived a point in time at which function-by-function replacement of hardwired controllers lost momentum and the inventive process that had led to numerous inventions in industrial contexts employing hardwired machines began to produce that having inventive merit, employing permanently softwired special purpose computers. This is readily appreciated with reference to a phenomenon known as "application pull", viz., the influence of real-world problems on the sequence of technical developments. Industry as a whole, having a requirement for increased efficiencies of production has tended to stimulate development of more sophisticated computing machine systems structured in accordance with algorithms designed for the physical realization of those efficiencies. Thus, new functions

are defined[10].

The remarks of the preceding paragraph are intended to provide an introduction of the factors influencing the choice of a microcomputer (incorporating firmware) as the appropriate medium of implementation within industrial contexts suggesting minicomputers as at least a feasible choice. Microcomputers, defined most simply as combinations of semiconductor read-only memories with integrated circuit microprocessors, lend themselves to a distribution of processing functions among low-cost individual computing elements. Industrial problems defined by application pull, since the introduction of the minicomputer, now can be solved by distributing portions of an overall sequencing algorithm among many microcomputers to form a machine system equivalent on a function-by-function basis to a properly softwired minicomputer. The cost of the microcomputers collectively suitable for algorithm implementation would be, in many instances, trivial in comparison with a minicomputer dedicated to the same task.

One does not automatically select firmware as the medium of implementation. This is because the engineering costs may be quite high. A larger portion of the pyramid is yet to be constructed. Rather than the relatively sophisticated adaptable

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10. R. K. Jurgen, "Minicomputer Applications in the Seventies", IEEE Spectrum, (August 1970); G. Lapidus, "A Look at Minicomputer Applications", Control Engineering, (November 1969); C. B. Newport, "Maturing Mincomputers", The Honeywell Computer Journal, 1971.

structure of the minicomputer, apparent to the engineer from an examination of the instruction set, there is the primitive microprocessor which will respond ultimately to an instruction set yet to be completely specified. The definition may be tailored to a specific industrial context[11]. Further, even the slightest changes in a machine system relying on read-only memory technology require physical insertion of a different memory element, whereas the same changes could be made with relative ease by alterations, combinations and permutations of the minicomputer's instruction set.

Although firmware implementations have demerits as well as merits, they may present an economically attractive alternative, particularly in those instances where the principal part of the engineering costs have already been absorbed by a competitor in softwiring a minicomputer. Copying on a function-by-function basis reduces engineering costs to just those of the implementation without design feedback. The computational algorithm is proven as is at least one sequencing algorithm.

Amicus submits that the technological facts present a logical imperative, viz., that the alternative media of implementation are engineering equivalents. The Lower Court's noninfringement conclusion is predicated on a misapprehension of those facts which

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11. Samir Husson, Microprogramming: Principles and Practice, Prentice-Hall, Inc., Englewood Cliffs, New Jersey (1970).

conclusion is tantamount to the conversion of a technological something (a software programmed machine system) into a judicial nothing. The conclusion that:

> "... A machine system is not infringed by another machine system which does not as a permanent machine system include the same combination of means. ..." 187 USPQ at 640.

which in the second instance purportedly characterizes the true nature of the software programmed machine system, does nothing of the sort for at least these reasons:

1. The software program (collection of signals specifically directing circuit interconnections) defining the interaction of the elements of the system is as permanent as need be the case. Economic considerations, particularly as respects efficient utilization of the maxicomputer, may dictate that the program be introduced only periodically into the memory of the computer. The requirement for periodic storage of the program in the memory may continue indefinitely. It is difficult to comprehend how indefinitely available and permanently existent are distinct in any meaningful sense. The signals exist somewhere all the time.
2. While the same statement that applies to efficient utilization of the maxicomputer may apply to the minicomputer, it typically does not. The program is always in the memory of the computer because it is always required.

Thus, the general purpose minicomputer is converted by software programming once, as opposed to periodically. It isn't perceived how this can be less than permanent.

Amicus submits that if the physical entity that is the software programmed machine system is to be a judicial nullity, it must necessarily follow that:

1. Both hardware and firmware implemented machine systems may be copied by software programming; and,

2. Software programmed machine systems may be copied by utilization of any of the media of implementation, singular,or mixed,

in each instance, with impunity.

Only alignment of judicial precedent with the technological fact of the engineering equivalents of the alternative media of implementation can prevent this.

C. Whether Temporarily Or Permanently Defined, A Special Purpose Computer Structured By Software Programming Is A New Machine.

The Lower Court's conclusion of noninfringement appears to be based on the rationale that:

> "The programmed general-purpose computer does not do the racetrack job; it does the same task but not by the same or equivalent machine means. Rather, it performs the tasks ... by a new use of a known machine, and that is a process under 35 U.S.C. 100 (b)." 187 USPQ 640.

The term "new use of a known machine" within this context, can only be interpreted logically as "the present introduction of data signals into a machine previously programmed to accept those signals, to store, retrieve, combine or otherwise manipulate them in accordance with all or some portion of an algorithm defining the sequencing of that machine, toward the end of solving all or some portion of a well-defined problem". In this sense is it a given machine, known to have a given use; in use. This is, more precisely, the anticipated use of a new machine, and that is not a process under 35 U.S.C. 100 (b).

As has been previously pointed out, the introduction of a spurious signal into a programmed digital computing machine, i.e., one for which there exists no logic path along which it may be routed to be stored, retrieved, combined or otherwise manipulated, produces no predictable result. Therefore, this "known machine" ("new machine" characterized by its program) may have no "new use" distinct from that for which it has been programmed.

Amicus submits that, to a general purpose digital computer having no physically incorporated sequencing algorithm (stored program), all signals are spurious. Only an unpredictable result may be obtained by the introduction into such computer of any signal. There can be no "new use" because there is no "old use"; by definition. Unpredictable results are useless per se.

The Lower Court does not focus on a meaningful distinction, of

paramount importance, in determining the true nature of the technological facts of the instant case. A new use of a general purpose digital computer proceeds in two logical steps: 1) adaptation of the general purpose digital computer to form a new special purpose digital computer; and, 2) introduction into the computer so formed of data signals within the domain of definition of signals for which there exists a range of results defined identically by the unique interconnection of circuits within that computer.

A new use of a known computer is a new use of a computer known by the program by which it is characterized, which is precisely equivalent to, or, even synonymous with, unexpected use. An unexpected "use" is clearly impossible because unpredictable results obtain, which are useless. There may be only anticipated uses of this computer.

Stated succinctly, the Lower Court ignores the distinction between adaptable and adapted and concludes, in substance, that a general purpose digital computer is inherently capable of solving all problems.

Amicus purchases general purpose digital computers under the terms of an Original Equipment Manufacturer's Discount Agreement. Amicus, as vendee under the terms of the agreement, purchases PDP-8 general purpose minicomputers and adapts them to a plurality of end uses. The principal product, or, equivalently, original equipment, of Amicus is the Quick-Path Computer formed at least in part from

adaptations of components of the PDP-8. The vendor has not the capability of solving problems solved by the software structured Quick-Path Computer. By exhibition of a single counterexample, within an actual commercial context, the proposition that the general purpose digital computer solves all problems is reduced to absurdity.

The special purpose computer structured by software programming, whether temporarily or permanently, is a new machine.

CONCLUSION

The judgment of noninfringement should be reversed.

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UNITED STATES COURT OF APPEALS

SECOND CIRCUIT

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Digitronics Corp., Now Amperex Electronic Corp.,

Plaintiff-Appellant-Appellee,

v.

The New York Racing Association, Inc., Automatic Totalisators (U.S.A.) LTD., Automatic Totalisators LTD., and Premier Equipment Proprietary LTD.,

Defendants-Appellees-Appellants.

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Docket No. 76-7063

AFFIDAVIT OF CHARLES W. SIMS

Charles W. Sims, being duly sworn, deposes and says that:

1. He is counsel for Amicus Curiae Digital Systems Corporation in the above-identified action.

2. He researched, drafted and reviewed the accompanying Brief Amicus Curiae.

3. Each of the statements of fact in the accompanying Brief Amicus Curiae is true on his own knowledge or, on information and belief, is believed to be true.

Charles W. Sims

Charles W. Sims

Subscribed and sworn to before me

this 3rd day of August, 1976.

Emma J. Schafer

EMMA J. SCHAFER, Notary Public
In and for Montgomery County, Ohio
My Commission Expires Nov. 22, 1976

CERTIFICATE OF SERVICE

I, Charles W. Sims, do hereby certify that two copies of the foregoing Brief Amicus Curiae, on behalf of D 'tal Systems Corporation, were served by Air Mail, postage prepaid, on this 7th day of August, 1976, upon the following:

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